Denver Water

Operations & Maintenance Division
Standard Operating Procedure
Subject : Clear water storage basins
Item : Routine maintenance
Date : November 15, 1999
Revision Date:

Purpose

A. To establish guidelines for the inspection, maintenance, cleaning and disinfection of clear water storage reservoirs in the Denver Water distribution system.
B. Also to establish safety procedures which will provide adequate protection for workers and the public.

Policy

A. It shall be the policy of Denver Water to conduct routine and systematic inspections followed by required maintenace and a thorough cleaning and disinfection of all clear water storage reservoirs in the water distribution system once every year.
B. It shall be the policy of Denver Water to maintain correct positioning of all valves relating to a storage facility in order to assure the quality of water delivered to the customer.
C. It shall be the policy of Denver Water that any necessary repairs found to be required in order to preserve the integrity of clear water storage reservoirs are completed in a timely manner.

Equipment

A. Workers must be provided with personal safety equipment i.e. hard hat, traffic safety vest, toe protection. Additional equipment needed for disinfection procedures are lung, eye and skin protection.
B. Reservoirs must be supplied with wash water supply systems sized adequately to insure all debris can be flushed thoroughly to floor drains.
C. Clean hoses used only for the purpose of reservoir cleaning are required.

Procedure for draining

A. Operators are required to report draining operations to the proper authorities predetermined for each facility.
    1. This includes CDPHE, local goverments, internal quality control personnel and drainage districts.
B. Total gallons to be drained, flow estimates and duration of draining must be reported.
C. Outflow must be periodically checked to prevent property damage.

D. Cleaning and / or disinfection crews must be given ample notice to prevent delays in returning the facility to normal use.

Procedure for reservoir maintenance

A. Close inspection of all surfaces inside a storage facility must be conducted including stairs and ladders..
B. Repairs to any rough surface that may collect debris must be made.
C. All hoses used for cleaning must inspected and found to be be clean and to have not been used for any other purpose.
D. An inspection of entry doors or hatchs must be conducted to insure all close and seal tightly.
E. Bug screens must be inspected for proper fit and general integrity.
F. Support structures such as foundations and pillars should be inspected for signs of movement or deterioration.
G. Signs of corrosion should located and repaired.
H. Site drainage should be evaluated and any pooling of rain water or runoff collection around a reservoir should be prevented.
I. Signs of leakage point to specific areas in need of repair.
J. Records of necessary repairs and actions taken must be maintained for the life of a given facility.

Procedure for cleaning

A. Basic cleaning is generally done with a high pressure water wash while areas with more stubborn surface buildup must be scrubbed with heavy brooms or brushes.
B. Loose guard railings, concrete scaling, concrete pitting etc. are examples of situations where debris may collect or bacteria may grow.
C. Chronic quality problems may be remedied with the design and proper placement of baffles or flow diverter which have the effect of ehancing the circulation of water within a storage reservoir.
D. Sealing of even the smallest cracks in roofs, or area where walls and roofs meet is required.
E. Cathodic protection to exposed metal surfaces will help prevent rust discoloration of stored water, as well as, preventing increased iron levels.
F. Testing of valves which are not accessable under normal operational circumstances should be conducted. Repairs or replacements should be done at this time.
G. If quality of water has been a chronic problem in the past this maintenance period is the time to have specialists look at solutions to circulation and short-circuiting situations. Baffels , single or in a series for example can promote bettter mixing and improve flow characteristics within a reservoir.

Procedure for disinfection

A. All workers must wear eye, lung and skin protection.
B. A qualified person must determine the amount of chlorine needed for proper disinfection.

C. All surfaces – walls, ceilings, ladder and floors must be disinfected.
D. No entry is allowed after a reservoir has been disinfected.
E. Early notification of an operations crew should be made in order to return the reservoir to service in a timely manner.
F. Wash water lines should be shut off after cleaning and disinfection to prevent a broken wash line from overflowing a reservoir should it break during normal operation.

Procedure return to service

A. All valves relating to a clear water storage reservoir should be clearly marked to prevent operational mistakes which may contaminate a clean basin.
B. Storage facilities should be provided with a site specific map which clearly illustrates valves and piping.
C. Only experienced personnel should make operational decisions.
D. Once a reservoir has been cleaned & disinfected, it should be filled with only clean, high quality water.
    1. For example, water from a second uncleaned basin must not be allowed to fill a newly cleaned reservoir.

Operation procedures

Some routine guidelines, if followed, will help to maintain the clear water storage reservoir in a clean and healthful condition until it is cleaned again.

A. Water system operators must fluctuate water levels within a storage reservoir as much a prudently possible based upon testing results.
B. Planning concerning pumping schedules with the maintainence of water quality in mind is essential.
C. Daily consideration of water quality sample test results assist in operational decisions.
    1. The best tool for maintaining high quality water in a storage reservoir is early detection or spotting trends that point to deterioration of the product.
D. Daily facility inspections by experienced personnel will detect vandalism or breaches of security such as open or missing locks, open hatches and signs of animal burrowing or bird nesting.
    1 A buildup of animal waste or nesting material may point to a location where an opening may exist.
E. Perimeter fences and gates should be inspected daily to detect unauthorized entry to the vicinity of the storage reservoir. Again, early detection can prevent vandalism that may take place and/or escalate over several days.

Emergency maintenance

If it is discovered through routine inspection or through sample test results that the clear water storage reservoir locks and hatches have been opened by unknown parties or if the quality of water samples have deteriorated, the reservoir must be immediately isolated. A separate SOP for emergency maintenance should be consulted and followed in these circumstances.